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<p>(54) Title: PACKAGING OF FLEXIBLE ARTICLES</p> <p>(57) Abstract</p> <p>The present invention is a package (1) containing an array (3) of flexible absorbent articles (5) (compressed or otherwise). Each absorbent article comprises a front face (7), a back face (9), a top face (6), a bottom face (8), a pair of side faces (10), an upper section (11), and a lower section (13). The upper (11) and lower (13) sections have mutually different caliper. At least a portion of the absorbent articles (5) are placed in a configuration such that their front faces (7) are in a contacting relationship with the front faces (7) of the adjacent absorbent articles. The package (1) comprises a flexible outer casing (19), an array (3) of absorbent articles (5) having a first region (15) and a second region (17) and the upper (11) and lower (13) sections of the absorbent articles are distributed over the first (15) and second (17) regions is at least about 10 % smaller that when all of the upper (11) sections of the absorbent articles (5) are located in the same region of the array (3).</p>		

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## PACKAGING OF FLEXIBLE ARTICLES

### FIELD OF THE INVENTION

The invention relates to the packaging of flexible articles, in particular, disposable absorbent articles including diapers, underpants, guards-for-men garments, sanitary napkins, incontinence pads, undergarments, or briefs. The packaging comprises a flexible outer casing in which the absorbent articles are arranged within the outer casing  
5 such that the articles are placed in an array such that at least a portion of their front faces are in a contacting relationship.

### BACKGROUND OF THE INVENTION

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In today's markets, product and material costs as well as handling, shipping and display concerns impact packaging users. Producers of consumer products, such as absorbent articles, desire to hold production's material cost to a minimum, such as balancing packaging appeal to customers with the lowest cost of packaging materials and  
15 production costs associated with each packaging design. In addition, handling, shipping, and display space constraints further the optimal use of packaging.

It is known that during packaging, variations in the arrangement of flexible articles, such as absorbent articles, within the packaging can result in situations in which the  
20 flexible outer casing is not filled to an optimal extent. In addition, if a high degree of compression occurs, certain regions of the articles may be affected, such as elastic elements, including waist bands, standup cuffs, and elasticized side panels, mechanical fasteners, and absorbent cores in absorbent products. This could cause damage to the articles or reduced performance of the articles.

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When flexible disposable articles, including absorbent articles, are packaged, compressed or otherwise, the volume size differences or changes that may occur can lead both to "wedge-like" shaped packaging and to the articles popping out of the outer casing at an inopportune time or in an undesired manner, i.e. two or three at a time. To  
30 counteract such situations, special configurations of the articles within the outer casing

can be taken to better distribute the mass or bulk of the absorbent articles. However, a typical consequence of such configurations may be the reduction of the speed of packaging, and accordingly, the speed of production would also be reduced. In addition, the difference in the caliper of the different parts of the articles, especially absorbent articles, may lead to relatively unstable and easily deformable packages. Therefore, the shipment, storage, and displaying of such unstable packages cause a variety of problems and difficulties. The problems discussed above can be exasperated when compressed packaging is utilized.

It is known that an array of flexible articles, compressed or otherwise, comprising one or more unit packages that may be maintained in their packaged configuration by a paper or plastic wrapping. The whole array can be encircled in a flexible covering made from a film typically of a thermoplastic material. An alternative type of a package unit uses the configuration wherein the flexible articles are folded and packed in a "head-to-tail" configuration. However such a configuration may require the presence of individual paper wrappers to maintain the array. A downside to such a configuration is that the consumer would have to tear open the outer plastic flexible covering and remove the inner paper or plastic wrappers placed across the width of the products. These concerns become even more important when compressed packaging is used.

In view of the above problems, the present invention seeks to provide a package comprising an array of flexible articles, compressed or otherwise, that:

- A. makes efficient use of the available packaging volume by redistributing the orientation of the flexible articles before packaging;
- B. can be, if desired, compressed to a relatively small volume without causing damage or a significant reduction in the performance of the articles, especially absorbent articles;
- C. improves the optimal use of the free space inside outer casing and shipping units (corrugated cases) and improves pallet usage;
- D. is stable and uniform with regards to shape (tending towards a rectangular, square, or other designated design for a better fit when the package is shipped, stored, or displayed) and provides for an improved appearance;

- 5
- E. allows for easier consumer access to the articles, especially absorbent articles, contained within the flexible outer casing when the outer casing is opened;
- F. allows ease in removal of a single article, especially an absorbent article, for use from the package;
- 10 G. eliminates the need for inner shapes, wrappers, or compression as a means for maintaining a desired configuration of the articles;
- H. reduces material and shipping costs in allowing more articles, especially absorbent articles, in smaller packages;
- 15 I. provides an easier process for placing the articles in the package; and,
- J. distributes the compression force more uniformly across the package, eliminating distinct high and low compression areas within the package.

20 The invention further discloses a relatively simple and reliable method for the packaging (compressed or otherwise) of an array of flexible articles while maintaining or increasing the speed and efficiencies of production.

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### **SUMMARY OF INVENTION**

The present invention is a package comprising an array of flexible articles, which are housed in a flexible outer casing. The array of the articles, such as absorbent articles, has two regions, namely a first region and a second region. Each article comprises a top  
30 face, a bottom face, a front face, a back face, and a pair of side faces that are distributed over the first and second region of the array of articles. For simplicity, the relevant parts of the top, front, back, and side faces of the article are referred to as the upper section and the relevant parts of the bottom, front, back, and side faces of the article are referred to as the lower section. The upper and lower sections may have mutually different  
35 caliper, wherein caliper is understood to mean thickness or bulk. This is especially obvious in absorbent articles.

In standard packaging processes, the articles, such as absorbent articles, are aligned in an array wherein the back face of one article is in a contacting relationship with the front face of the adjacent article, and the bottom face of the first article is adjacent the bottom face of the adjacent article. According to the configuration of articles within the array of present invention, at least a portion or a predetermined number of articles within the array are in a front face to front face contacting relationship with adjacent articles (or alternatively, in a back face to back face contacting relationship). In addition, at least a portion or a predetermined number of the articles within the array may be in a top face to bottom face relationship with adjacent articles. Typically, the articles in a front face to front face contacting relationship with adjacent articles (or alternatively, in a back face to back face contacting relationship) are the articles in the top face to bottom face relationship with the adjacent articles.

The difference in the size (or the compression force for compression of the articles, especially absorbent articles, when compressed packaging is being utilized) of the first and second regions when the upper and lower sections are distributed throughout the array of articles is at least 10% smaller than the difference in the size of the articles (or the compression force for compression of the articles when compressed packaging is being utilized) of the largest region when all the upper sections of the articles are located in the same region of the array of the articles. When a compression force is applied to the articles, the articles are compressed to between about 10% to about 75% of their uncompressed volume.

By redistributing the orientation or configuration of the articles within the array before packaging, the packaging of the array of the articles becomes more uniform. In the situations when compressed packaging is being utilized, the array of articles is typically reoriented before the compression force is applied. While it is not necessary to reorient the articles within the array before the compression force is applied to the array, the array of articles will be more stable for processing if the array is reoriented prior to the compression. The difference in the size of the upper and lower sections of the articles in the reoriented array, in order to obtain an equal distribution of the articles or volume of the first and second regions, is therefore reduced.

Such a reorientation provides for an optimal use of volume or space within the outer casing. This reorientation also prevents over-compression of various parts of the

articles where compressed packaging is being utilized. The reorientation reduces or prevents damage to the articles, especially absorbent articles, and maintains or improves the performance of the articles, especially absorbent articles. In addition, the tendency for the articles to pop out of the outer casing during handling is reduced.

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Using the reoriented configuration of the present invention for the array of articles, more articles can be included in a single array before the array becomes unstable. In this way, the packaging process is simplified and the speed of the production of the articles is maintained or increased while providing a more stable product package having the advantages stated above.

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In addition, an improvement in the load bearing properties and shape stability of the package occurs. The packages of the reoriented array of articles, especially absorbent articles, can be stacked in a more stable manner for shipping, handling, and display. It has also been found that a package according to the present invention can be compressed by at least 10% more in the direction of compression in comparison to a package comprising an equal number of articles wherein all the upper sections are located in the same region of the array of the articles.

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In one embodiment of packaging according to the present invention, the articles are distributed within the array in such a manner that the size (or the compression forces when compressed packaging is utilized) for the first and second regions of the array of the articles are substantially equal. In this way, it is possible to simplify the packaging apparatus to accommodate the need for a variety of bag sizes. In the case when compressed packaging is utilized, the compression apparatus can be simplified as the pivoting preventive support for the compression plates to accommodate the different compressibilities of the array of articles can be reduced.

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Alternatively, the array of the articles, especially absorbent articles, may be orientated in such a manner that after compression the expansion force of the first region of the array is substantially equal to the expansion force of the second region in order to counteract deformation of the package upon removal of the compression forces.

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An array of articles can be formed by stacking bi-folded absorbent articles, such as diapers, together, which have either non-uniform caliper or have low and high density regions. As it is known that a bi-folded diaper is folded once on itself at its crotch region.

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Such bi-folded diapers typically have a rounded upper section having a high compression resistance, which corresponds to the crotch region of the unfolded diaper, and a lower section with a low compression resistance, which corresponds to the waist regions of the unfolded diaper. The maximum improvement in the packaging can be achieved when the orientation of the rounded upper sections is alternated within the array of the absorbent articles. The orientation however of the upper sections may also be alternated for groups of two or more articles, and the number of rounded upper sections in the first and second regions of the array of compressed diapers need not necessarily be equal. Articles, such as absorbent articles, to be considered may also be tri-folded, bi-tri-folded, or be folded by any of a variety of folds.

The term "compressibility" is intended to mean the reduction in volume when a predetermined force is applied to an article or to an array of articles, especially absorbent articles. This reduction in volume may be between 20% and 70% of the uncompressed volume.

#### **BRIEF DESCRIPTION OF THE DRAWINGS**

A better understanding of the present invention can be achieved in conjunction with the study of the attached drawings.

**FIGURE 1** shows a known package comprising an array of flexible articles, such as absorbent articles;

**FIGURE 2** shows a perspective view of folded articles having upper and lower sections of similar compressibilities or caliper;

**FIGURE 3** shows a perspective view of folded articles, such as absorbent articles, having upper and lower sections of different compressibilities or caliper;

**FIGURE 4** shows a perspective view of folded articles, such as absorbent articles, having upper and lower sections of different compressibilities or caliper;

**FIGURE 5** shows two packages of articles, such as absorbent articles, having deformed corners due to a higher compressibility in the lower regions of the packages;

**FIGURE 6** shows a packaging apparatus;

**FIGURE 7** shows a compression packaging apparatus;

**FIGURE 8** shows a compression packaging apparatus;



**FIGURE 9** schematically shows arrays of articles, such as absorbent articles, having differently distributed orientations;

5 **FIGURE 10** schematically shows arrays of articles, such as absorbent articles, having differently distributed orientations;

**FIGURE 11** schematically shows arrays of articles, such as absorbent articles, having differently distributed orientations;

10 **FIGURE 11a** schematically shows arrays of articles, such as absorbent articles, having differently distributed orientations;

**FIGURE 11b** schematically shows arrays of articles, such as absorbent articles, having differently distributed orientations;

15 **FIGURE 12** schematically shows arrays of articles, such as absorbent articles, having differently distributed orientations;

**FIGURE 13** shows a plan view of a disposable diaper in the flattened state; and,

20 **FIGURE 14** shows a cross-sectional view of the diaper taken from the view line 13 - 13' in **FIGURE 13**.

25 **DETAILED DESCRIPTION OF THE INVENTION**

**FIGURE 1** shows a package 1 comprising an array 3 of folded, flexible articles 5, such as absorbent articles, the array 3 shows a first region 15 and a second region 17. The articles 5 may be compressed within the package 1. The articles 5 may comprise  
30 diapers, underpants, undergarments, guards-for-men garments, sanitary napkins, incontinence pads or any other type of absorbent article as well as clothing, gowns, medical drapes, masks, and other protective coverings. When compressed, the articles 5, especially absorbent articles, are compressed to between about 0% and about 90%, more typically about 0% and about 80%, more typically about 10% and 75%, and most typically  
35 about 20% and 70% of their uncompressed volume. The articles 5 are contained within a flexible outer casing 19, with portions of the structure of the flexible outer casing 19 being cut away in **FIGURE 1** to more clearly show the array 3 of the articles 5, in this case absorbent articles, within the package 1. The flexible outer casing 19 maintains the array 3 of articles 5 (compressed or otherwise), and may comprise a thermoplastic bag or a  
40 paper bag, as it is known in the art.

In standard packaging processes, the articles 5 are aligned in an array 3 wherein the back face 9 of one article 5 is in a contacting relationship with the front face 7 of the

adjacent article 5, and the bottom face 8 of the first article 5 is adjacent the bottom face 8 of the adjacent article 5.

According to the configuration of articles 5, such as absorbent articles, within the array 3 of the package 1 of the present invention, at least a portion or a predetermined number of articles 5 within the array 3 are in a front face 7 to front face 7 contacting relationship with adjacent articles 5 (or alternatively, in a back face 9 to back face 9 contacting relationship). In addition, at least a portion or a predetermined number of the articles 5 within the array 3 may be in a top face 6 to bottom face 8 relationship with adjacent articles 5. The two portions of articles 5 may or may not be the same articles 5.

Typically, according to the present invention, the articles 5 in a front face 7 to front face 7 contacting relationship with adjacent articles 5 (or alternatively, in a back face 9 to back face 9 contacting relationship) are the articles 5 in the top face 6 to bottom face 8 relationship with the adjacent articles 5. In such a configuration, the articles 5 in the front face 7 to front face 7 contacting relationship with adjacent articles 5 (or alternatively, in a back face 9 to back face 9 contacting relationship) would also be the articles 5 within the array 3 in a top face 6 to bottom face 8 relationship with adjacent articles 5.

However, the articles 5 in the front face 7 to front face 7 contacting relationship with adjacent articles 5 (or alternatively, in a back face 9 to back face 9 contacting relationship) are not required to be the articles 5 within the array 3 are in a top face 6 to bottom face 8 relationship with adjacent articles 5.

Between 10 and 100 absorbent articles 5 are typically comprised in the array 3. Where the articles 5 are not absorbent articles, between 10 and 1000 articles 5 are typically comprised in the array 3. As illustrated in **FIGURE 2**, each folded article 5 comprises a front face 7, a back face 9, a top face 6, a bottom face 8, and a pair of side faces 10. Within the array 3, the articles 5 are placed with at least a portion of their front faces 7 in a contacting relationship. Similarly, at least of a portion of the back faces 9 of the articles 5 are in a contacting relationship. Each article 5 comprises an upper section 11 and a lower section 13, as defined in the "Summary of the Invention".

In the embodiment of **FIGURE 1**, all the upper sections 11 are located in the first region 15 of the array 3 of articles 5. As the first region 15 of the array 3 of the articles 5 has a larger size (or a higher compression resistance when considering compressed

packaging) than the second region 17, the first region 15 of the array 3 of the articles 5 will have a larger size or volume than the second region 17. In compressed packaging, the first region 15 of the array 3 of the articles 5, especially when the articles 5 are absorbent, will have a larger size or volume after compression than the second region 17.

5 This may result in a package 1 of irregular or non-uniform dimensions (non-rectangular, non-square, ect.). Under such situations, the second region 17 of the package 1 will not be filled to an optimal extent. For example, when a rectangular shaped outer casing 19 is used for the package 1, the second region 17 of the package 1 will not be filled to an optimal extent.

10 **FIGURE 2** shows a folded flexible article 5, such as an absorbent article, which is of uniform caliper, i.e., the caliper 25 of the upper section 11 is substantially equal to the caliper 21 of the lower section 13. (However, the teachings apply to non-absorbent articles as well.) When different materials are incorporated into the upper section 11 than  
15 in the lower section 13, mutually different caliper may result. For example, the upper section 11 may comprise a higher concentration of absorbent gelling material particles or may comprise a resilient liquid acquisition material such as a foamed or a cross-linked cellulose material. Alternatively, the method or configuration used in folding the article 5, may result in the upper section 11 and the lower section 13 having mutually different  
20 caliper. Thus, after folding the articles 5, the caliper 25 for the upper section 11 and the caliper 21 for the lower section 13 of each article 5 and the dimensions of the first region 15 and the second region 17 of the array 3 of the articles 5, along a direction which is orthogonal to the front faces 7 and the back faces 9 of the articles 5, will be different.

25 **FIGURE 3** shows another embodiment of a folded article 5 wherein the lower section 13 comprises a gap 23 such that the size of the lower section 13 is decreased in comparison to the size of the upper section 11. (However, the teachings apply to non-absorbent articles as well.) Alternatively, if compressed packaging is being utilized, the embodiment of the folded article 5 wherein the lower section 13 comprises a gap 23 such  
30 that the compressibility of the lower section 13 is increased in comparison to the compressibility of the upper section 11. For many bi-folded articles 5, especially absorbent articles, the configuration of **FIGURE 3** will result as the caliper 25 corresponding to the crotch regions 14 of an article 5 is generally greater than the caliper 21 corresponding to the waist regions 12 of the articles 5. In the folded article 5 of  
35 **FIGURE 3**, the crotch region 14 forms the upper section 11 and the waist regions 12 form the lower section 13.

In **FIGURE 4**, a folded article **5** is shown which has a smaller caliper **21** for the lower section **13** in comparison to the caliper **25** of the upper section **11**. (However, the teachings apply to non-absorbent articles as well.) When the absorbent articles **5** of **FIGURES 2, 3, and 4** are stacked in an array **3** of the articles **5**, as shown in **FIGURE 1**, the sizes will be different for the first and second regions **15** and **17** of the array **3** of the absorbent articles **5**. When the articles **5** are stacked as such and subsequently compressed, the compression force will be different for the first and second regions **15** and **17** of the array **3** of the articles **5**. These situations typically result in a package **1** of irregular dimensions, especially where the articles **5** are absorbent. Alternatively, the package **1** may have uniform or regular (such as rectangular or square) dimensions that are easily deformable in the second region **17**.

**FIGURE 5** shows a configuration wherein two packages **27** and **29**, each similar to package **1**, are combined by means of a stretch wrap film **30**. In situations where the size of the first region **15** of the packages **27** and **29** is greater than the size of the second region **17**, the packages **27** and **29** are deformed at their second regions **17**. Alternatively, when compressed packaging is being utilized and the compressibility of the first region **15** of the packages **27** and **29** is less than the compressibility of the second region **17**, the packages **27** and **29** are deformed at their second regions **17**. Where compressed packaging is used, the articles **5** within the packages **27** and **29**, will have an expansion force. The expansion force is a result of the compressed articles **5** returning or attempting to return to their original (non-compressed) state. The articles **5**, will therefore, fill the space provided within the package **27** or **29**. Rounded corners **32** and **34** are formed as the stretch wrap film **30** compresses the lower sections **13** of the articles **5** located in the second region **17**. Therefore, the combined packages **27** and **29** cannot be stacked with other similar packages in a stable manner.

**FIGURE 6** shows a schematical view of how an array **3** of articles **5** is aligned between two belts **36** and **38**. Where compressed packaging is used, compression may be applied to individual articles **5**, articles **5** in an array **3**, or to both the individual article **5** and the array **3**. Where compression is applied to articles in an array, the belts **36** and **38** would be compression belts. Each belt **36** and **38** comprises a member **39** and **40**, respectively. Each belt **36** and **38** can provide compression force to the array **3** of the articles **5**. When compression force is applied, the array **3** of the articles **5** is compressed to between about 0% and 90%, more typically about 0% and about 80%, more typically

about 10% and 75%, most typically about 20% and about 70% of its uncompressed volume in the direction of the arrows F by moving the members 39 and 40 together with a force that can be as great as 2000 kg. After alignment or compression of the array 3, the belts 36 and 38 are inserted through a bottom surface 44 of a bag 42, as shown in

5 **FIGURE 7.** The array 3 of articles 5 is inserted into the bag 42 by rotation of the belts 36 and 38. After the array 3 has been inserted into the bag 42, the belts 36 and 38 are retracted from the bag 42, which is subsequently sealed on the bottom surface 44. (Loading of an array 3 of the articles 5 can also be accomplished by using a pusher system.) The bag 42 comprises a handle 41 and an opening device 43, which is formed

10 by a line of weaknesses (perforations) on one of the side surfaces 45 or 46 of the bag 42. This is one method of packaging compressed articles 5. The invention is not intended to be limited to this particular embodiment for packaging compressed articles 5.

**FIGURE 8** shows that during compression of the array 3 of the articles 5 between

15 the compression belts 36 and 38, each article 5, absorbent or otherwise, is squeezed tightly in the first region 15 of the array 3. This will cause the articles 5 to be squeezed out of the array 3 in the direction of the arrows S or S', S'' or S''' depending on the uniformity of the articles 5. Due to the movement of the articles 5 within the array 3, additional compression restraining means are necessary to prevent such a break up of

20 the array 3.

**FIGURE 9** shows the preferred orientation of the articles 50 and 52, absorbent or otherwise, according to the invention. The number of upper sections 11 and lower sections 13 of the articles 50 and 52 in the first region 15 of the array 3 is either equal to

25 the number of upper sections 11 and lower sections 13 of the articles 50 and 52 in the second region 17 of the array 3 or it differs by one. In this way, the compression force necessary to compress the first region 15 is substantially equal to the compression force that is required to compress the second region 17 of the array 3.

In **FIGURE 10**, the articles 5, absorbent or otherwise, are arranged into groups 53, 55, 57, and 59 such that the upper sections 11 of the articles 5 in groups 53 and 57 are located in the first region 15 of the array 3 of the articles 5 and the upper sections 11 of the articles 5 in groups 55 and 59 are located in the second region 17 of the array 3 of the articles 5. The number of the articles 5 comprised in each group may vary from 2, as

35 illustrated in **FIGURE 11**, to half the number of the articles 5 in the package 1, as illustrated in **FIGURE 12**. The preferred embodiment occurs when the number of groups

are equal to each other, each group comprising a predetermined equal number of the articles 5.

**FIGURES 11a and 11b** show two of the possible different configurations of the articles 5 within the array 3. As discussed, shown in **FIGURE 11a**, the predetermined number of the articles 5 in the common orientation of the front face 7 to back face 9 contacting relationship of the articles 5 is changed to a front face 7 to front face 7 (or back face 9 to back face 9) contacting relationship of the present invention may be the same predetermined number of the articles 5 wherein the bottom face 8 to bottom face 8 (or top face 6 to top face 6) contacting relationship of the common orientation is changed to a bottom face 8 to top face 6 contacting relationship of the present invention. **FIGURE 11b** shows a configuration wherein the predetermined number of the articles 5 having a front face 7 to front face 7 (or back face 9 to back face 9) contacting relationship may not be the same predetermined number of the articles 5 having the bottom face 8 to top face 6 contacting relationship of the present invention.

**FIGURE 13** shows a plan view of a flattened disposable article 58, such as a diaper. The article 58 comprises a liquid pervious topsheet 60 and a liquid impervious backsheet 61. In **FIGURE 13**, the topsheet 60 has been largely cut away to show the underlying features. The article 58 comprises an absorbent core 63, which may comprise cellulosic fibres and hydrogel forming particles. (The absorbent core 63 may comprise any structure or material which is used for the absorption of bodily fluids. The discussion herein is not intended to limit the absorbent core 63 to the structure discussed.) A central acquisition patch 65 is placed in the crotch region 64 of the absorbent core 63. Leg elastic elements 69 are located in the leg regions 68 of the article 58. Front and back waist elastics 66 in the corresponding front and back regions 76 and 74 may be comprised in the article 58. A fastening system 71, which comprises adhesive tape fasteners 72, is connected to the back region 74 of the article 58. The fastening system 71 may alternatively comprise mechanical fasteners or a combination of adhesive fasteners 72 and mechanical fasteners.

**FIGURE 14** shows a cross-section of the article 58 taken from the view line 13-13' in **FIGURE 13**. On folding the article 58 along the line 13-13', the central region of the article 58, comprising the acquisition patch 65, will have the highest caliper.

While the articles 5 discussed herein could be absorbent articles such as diapers, underpants, guards-for-men garments, sanitary napkins and other such products, incontinence pads, undergarments, or briefs, it is understood that the present invention would also apply to other consumer products, absorbent or otherwise, including hospital gowns, masks, gloves, medical drapes, protective clothing, clothing in general, and the like. The articles 5 may be disposable, semi-durable, or durable in nature. It is anticipated that the present invention would be most beneficial wherein the articles 5 being packaged are non-uniform in shape once the articles 5 are folded.

The present invention is for a package 1 containing an array 3 of flexible articles 5. The articles 5 comprise a front face 7, a back face 9, a top face 6, a bottom face 8, a pair of side faces 10, an upper section 11, and a lower section 13. The sections 11 and 13 may have mutually different caliper 21 and 25. According to the present invention, at least a portion of the articles 5 are placed with the front faces 7 in a contacting relationship and at least a portion of the back faces 9 are in a contacting relationship. The package 1 comprises a flexible outer casing 19. The array 3 has a first region 15 and a second region 17. The upper and lower sections 11 and 13 of the articles 5 are distributed over the first and second regions 15 and 17 of the array 3. The distribution of upper and lower sections 11 and 13 is such that the difference in the size of the first and second regions 15 and 17 is at least about 10% smaller than when all of the upper sections 11 of the articles 5 are located in the same region 15 or 17 of the array 3.

The present invention may include a configuration wherein the upper and lower sections 11 and 13 of the articles 5 are distributed in such a way that the sizes of the first and second regions 15 and 17 of the array 3 are substantially equal. The package 1 of the present invention may have at least a portion of the articles 5 placed with the bottom faces 8 in a contacting relationship with the top faces 6 of the adjacent articles 5. The orientation of the articles 5 may be periodically alternated. The dimensions of the first region 15 of the array 3 may be substantially equal to the dimensions of the second region 17 of the array 3. The articles 5 may comprise different caliper 21 or 25 in the upper and lower sections 11 and 13. The package 1 of the present invention may not comprise an inner means, particularly not a paper wrapping to maintain the array 3 of the articles 5.

The present invention is also for a method of forming a package 1 comprising the following steps:

- a. transporting the articles 5 in a consecutive manner to a folding unit;

- b. folding the articles 5;
- c. changing the orientation of the articles 5 at regularly spaced intervals;
- d. aligning a predetermined number of the articles 5 with the front faces 7 or back faces 9 in a contacting relationship to form an uncompressed array 3, wherein a predetermined number of the articles 5 have their upper sections 11 located in a first region 15 of the array 3 and a second predetermined number of the articles 5 have their upper sections 11 located in a second region 17 of the array 3; and,
- e. placing the array 3 in a flexible outer casing 19.

The present invention is also for a package 1 containing an array 3 of compressed, flexible articles 5. The articles 5 comprise a front face 7, a back face 9, a top face 6, a bottom face 8, a pair of side faces 10, an upper section 11, and a lower section 13. The sections 11 and 13 may have mutually different compressibilities and caliper 21 and 25.

According to the present invention, at least a portion of the articles 5 are placed with said front faces 7 in a contacting relationship and at least a portion of the back faces 9 in a contacting relationship. The package 1 comprises a flexible outer casing 19. The array 3 has a first region 15 and a second region 17. The upper and lower sections 11 and 13 of the articles 5 are distributed over the first and second regions 15 and 17 of the array 3.

The distribution of the upper and lower sections 11 and 13 is such that the difference in the compression force for compression of the first and second regions 15 and 17 to between 0% and 90% of their uncompressed volume is at least 10% smaller than the difference in the compression force for compression of said first and second regions 15 and 17 when all of the upper sections 11 of the articles 5 are located in the same region 15 or 17 of the array 3. The flexible outer casing 19 maintains the array 3 of the compressed articles 5.

The present invention may include a configuration wherein the upper and lower sections 11 and 13 of the articles 5 are distributed in such a way that the compression forces for said first and second regions 15 and 17 of the array 3 are substantially equal. The package 1 may have at least a portion of the articles 5 placed with the bottom faces 8 in a contacting relationship with the top faces 6 of the adjacent articles 5. The orientation of the articles 5 may be periodically alternated. After compression, the dimension along the direction of compression of the first region 15 of the array 3 may be substantially equal to the dimension along the direction of compression of the second region 17 of the array 3. After compression, the expansion force of the first region 15 may be substantially



equal to the expansion force of the second region 17. The articles 5 may comprise different caliper 21 and 25 in the upper and lower sections 11 and 13. The package 1 may not comprise a inner means, particularly not a paper wrapping to maintain the array 3 of the compressed articles 5.

5

The present invention is also for a method of forming a package 1 comprising the following steps:

- a. transporting the articles 5 in a consecutive manner to a folding unit;
- b. folding the articles 5;
- 10 c. changing the orientation of the articles 5 at regularly spaced intervals;
- d. aligning a predetermined number of the articles 5 with the front faces 7 or the back faces 9 in a contacting relationship to form an uncompressed array 3, wherein a predetermined number of the articles 5 have their upper sections 11 located in a first region 15 of the array 3;
- 15 e. compressing the array 3; and,
- f. placing the compressed array 3 in a flexible outer casing 19.

The method of forming a package 1 may also include a second predetermined number of the articles 5 having their upper sections 11 located in a second region of 17  
20 the array 3.

The method of forming a package 1 may also comprise the following steps:

- a. transporting the articles 5 in a consecutive manner to a folding unit;
- b. folding the articles 5;
- 25 c. changing the orientation of the articles 5 at regularly spaced intervals;
- d. aligning a predetermined number of the articles 5 with the front faces 7 or the back faces 9 in a contacting relationship to form an uncompressed array 3, wherein a predetermined number of the articles 5 have their upper sections 11 located in a first region 15 of the array 3 and a second  
30 predetermined number of the articles 5 have their upper sections 11 located in a second region 17 of the array 3;
- e. compressing the array 3; and,
- f. placing the compressed array 3 in a flexible outer casing 19.

35 The method of forming a package 1 wherein the compression force is substantially uniform across the first and second regions 15 and 17.

The present invention is for a package 1 containing an array 3 of flexible absorbent articles 5. The absorbent articles 5 comprise a front face 7, a back face 9, a top face 6, a bottom face 8, a pair of side faces 10, an upper section 11, and a lower section 13. The sections 11 and 13 may have mutually different caliper 21 and 25. According to the present invention, at least a portion of the absorbent articles 5 are placed with the front faces 7 in a contacting relationship and at least a portion of the back faces 9 are in a contacting relationship. The package 1 comprises a flexible outer casing 19. The array 3 has a first region 15 and a second region 17. The upper and lower sections 11 and 13 of the absorbent articles 5 are distributed over the first and second regions 11 and 13 of the array 3. The distribution of upper and lower sections 11 and 13 is such that the difference in the size of the first and second regions 15 and 17 is at least about 10% smaller than when all of the upper sections 11 of the absorbent articles 5 are located in the same region 15 or 17 of the array 3.

The present invention may include a configuration wherein the upper and lower sections 11 and 13 of the absorbent articles 5 are distributed in such a way that the sizes of the first and second regions 15 and 17 of the array 3 are substantially equal. The package 1 of the present invention may have at least a portion of the absorbent articles 5 placed with the bottom faces 8 in a contacting relationship with the top faces 6 of the adjacent absorbent articles 5. The orientation of the absorbent articles 5 may be periodically alternated. The dimensions of the first region 15 of the array 3 may be substantially equal to the dimensions of the second region 17 of the array 3. The absorbent articles 5 may comprise different caliper 21 or 25 in the upper and lower sections 11 and 13. The package 1 of the present invention may not comprise an inner means, particularly not a paper wrapping to maintain the array 3 of the absorbent articles 5.

The present invention is also for a method of forming a package 1 comprising the following steps:

- a. transporting the absorbent articles 5 in a consecutive manner to a folding unit;
- b. folding the absorbent articles 5;
- c. changing the orientation of the absorbent articles 5 at regularly spaced intervals;

- 5           d.       aligning a predetermined number of the absorbent articles 5 with the front faces 7 or back faces 9 in a contacting relationship to form an uncompressed array 3, wherein a predetermined number of the absorbent articles 5 have their upper sections 11 located in a first region 15 of the array 3 and a second predetermined number of the absorbent articles 5 have their upper sections 11 located in a second region 17 of the array 3; and,
- e.       placing the array 3 in a flexible outer casing 19.

10           The present invention is also for a package 1 containing an array 3 of compressed, flexible absorbent articles 5. The absorbent articles 5 comprise a front face 7, a back face 9, a top face 6, a bottom face 8, a pair of side faces 10, an upper section 11, and a lower section 13. The sections 11 and 13 may have mutually different compressibilities and caliper 21 and 25. According to the present invention, at least a portion of the absorbent  
15 articles 5 are placed with said front faces 7 in a contacting relationship and at least a portion of the back faces 9 in a contacting relationship. The package 1 comprises a flexible outer casing 19. The array 3 has a first region 15 and a second region 17. The upper and lower sections 11 and 13 of the absorbent articles 5 are distributed over the first and second regions 15 and 17 of the array 3. The distribution of the upper and lower  
20 sections 11 and 13 is such that the difference in the compression force for compression of the first and second regions 15 and 17 to between 0% and 90% of their uncompressed volume is at least 10% smaller than the difference in the compression force for compression of said first and second regions 15 and 17 when all of the upper sections 11 of the absorbent articles 5 are located in the same region 15 or 17 of the array 3. The  
25 flexible outer casing 19 maintains the array 3 of the compressed absorbent articles 5.

          The present invention may include a configuration wherein the upper and lower sections 11 and 13 of the absorbent articles 5 are distributed in such a way that the compression forces for said first and second regions 15 and 17 of the array 3 are  
30 substantially equal. The package 1 may have at least a portion of the absorbent articles 5 placed with the bottom faces 8 in a contacting relationship with the top faces 6 of the adjacent absorbent articles 5. The orientation of the absorbent articles 5 may be periodically alternated. After compression, the dimension along the direction of compression of the first region 15 of the array 3 may be substantially equal to the  
35 dimension along the direction of compression of the second region 17 of the array 3. After compression, the expansion force of the first region 15 may be substantially equal to

the expansion force of the second region 17. The articles 5 may comprise different caliper 21 and 25 in the upper and lower sections 11 and 13. The package 1 may not comprise a inner means, particularly not a paper wrapping to maintain the array 3 of the compressed absorbent articles 5.

5

The present invention is also for a method of forming a package 1 comprising the following steps:

- a. transporting the absorbent articles 5 in a consecutive manner to a folding unit;
- 10 b. folding the absorbent articles 5;
- c. changing the orientation of the absorbent articles 5 at regularly spaced intervals;
- d. aligning a predetermined number of the absorbent articles 5 with the front faces 7 or the back faces 9 in a contacting relationship to form an  
15 uncompressed array 3, wherein a predetermined number of the absorbent articles 5 have their upper sections 11 located in a first region 15 of the array 3;
- e. compressing the array 3; and,
- f. placing the compressed array 3 in a flexible outer casing 19.

20

The method of forming a package 1 may also include a second predetermined number of the absorbent articles 5 having their upper sections 11 located in a second region of 17 the array 3.

25

The method of forming a package 1 may also comprise the following steps:

- a. transporting the absorbent articles 5 in a consecutive manner to a folding unit;
- b. folding the absorbent articles 5;
- c. changing the orientation of the absorbent articles 5 at regularly spaced  
30 intervals;
- d. aligning a predetermined number of the absorbent articles 5 with the front faces 7 or the back faces 9 in a contacting relationship to form an  
uncompressed array 3, wherein a predetermined number of the absorbent  
articles 5 have their upper sections 11 located in a first region 15 of the  
array 3 and a second predetermined number of the absorbent articles 5  
35 have their upper sections 11 located in a second region 17 of the array 3;

- e. compressing the array 3; and,
- f. placing the compressed array 3 in a flexible outer casing 19.

The method of forming a package 1 wherein the compression force is substantially  
5 uniform across the first and second regions 15 and 17.

While various patents and other reference materials have been incorporated herein  
by reference, to the extent there is any inconsistency between incorporated material and  
that of the written specification, the written specification shall control. In addition, while the  
10 invention has been described in detail with respect to specific embodiments thereof, it will  
be apparent to those skilled in the art that various alterations, modifications and other  
changes may be made to the invention without departing from the spirit and scope of the  
present invention. It is therefore intended that the claims cover all such modifications,  
alterations and other changes encompassed by the appended claims.

**We Claim:**

1. A package containing an array of flexible articles, said articles comprising a front face, a back face, a top face, a bottom face, side faces, an upper section and a lower section, said sections having mutually different caliper, wherein at least a portion of said articles are placed with said front faces in a contacting relationship and at least a portion  
5 of said back faces in a contacting relationship, said package comprising a flexible outer casing, said array having a first region and a second region and said upper and lower sections of said articles being distributed over said first and second regions of said array, wherein said distribution of upper and lower sections, is such that the difference in the size of said first and second regions is at least about 10% smaller than when all of said  
10 upper sections of said articles are located in the same region of said array.
2. A package according to Claim 1, wherein said upper and lower sections of said articles are distributed in such a way that the sizes of said first and second regions of said array are substantially equal.
3. A package according to Claim 2, wherein at least a portion of said articles are placed with said bottom faces in a contacting relationship with said top faces of adjacent articles.
4. A package according to Claim 1, 2, or 3, wherein the orientation of said articles is periodically alternated.
5. A package according to any preceding Claim, wherein the dimensions of said first region of said array is substantially equal to the dimensions of said second region of said array.
6. A package according to any preceding Claim, wherein said articles comprise different caliper in said upper and lower sections.

**7.** A package according to any preceding Claim, wherein said package does not comprise a inner means, particularly not a paper wrapping to maintain said array of said absorbent articles.

**8.** A method of forming a package according to Claim 1, comprising the following steps:

- a. transporting said articles in a consecutive manner to a folding unit;
- b. folding said articles;
- c. changing the orientation of said articles at regularly spaced intervals;
- d. aligning a predetermined number of said articles with said front faces or back faces in a contacting relationship to form an uncompressed array, wherein a predetermined number of said articles have their said upper sections located in a first region of said array and a second predetermined number of said articles have their said upper sections located in a second region of said array; and,
- e. placing said array in a flexible outer casing.

**9.** A package containing an array of compressed, flexible articles, said articles comprising a front face, a back face, a top face, a bottom face, side faces, an upper section and a lower section, said sections having mutually different compressibilities and caliper, wherein at least a portion of said articles are placed with said front faces in a contacting relationship and at least a portion of said back faces in a contacting relationship, said package comprising a flexible outer casing, said array having a first region and a second region and said upper and lower sections of said articles being distributed over said first and second regions of said array, wherein said distribution of said upper and lower sections, is such that the difference in the compression force for compression of said first and second regions to between 0% and 90% of their uncompressed volume, is at least 10% smaller than the difference in the compression force for compression of said first and second regions, when all of said upper sections of

said articles are located in the same region of said array; and said flexible outer casing maintains said array of said compressed articles.

**10.** A package according to Claim 9, wherein said upper and lower sections of said articles are distributed in such a way that the compression forces for said first and second regions of said array are substantially equal.

**11.** A package according to Claim 9, wherein at least a portion of said articles are placed with said bottom faces in a contacting relationship with said top faces of adjacent articles.

**12.** A package according to Claim 9, 10, or 11, wherein the orientation of said articles is periodically alternated.

**13.** A package according to Claim 9, 10, 11, or 12, wherein, after compression, the dimension along the direction of compression of said first region of said array is substantially equal to the dimension along the direction of compression of said second region of said array.

**14.** A package according to Claim 9, 10, 11, 12, or 13, wherein after compression the expansion force of said first region is substantially equal to the expansion force of said second region.

**15.** A package according to Claim 9, 10, 11, 12, 13, or 14, wherein said articles comprise different caliper in said upper and lower sections.

**16.** A package according to Claim 9, 10, 11, 12, 13, 14, or 15, wherein said package does not comprise a inner means, particularly not a paper wrapping to maintain said array of said compressed articles.



**17.** A method of forming a package according to Claim 9, comprising the following steps:

- 5           a.     transporting said articles in a consecutive manner to a folding unit;
- b.     folding said articles;
- c.     changing the orientation of said articles at regularly spaced intervals;
- 10          d.     aligning a predetermined number of said articles with said front faces or  
              back faces in a contacting relationship to form an uncompressed array,  
              wherein a predetermined number of said articles have their said upper  
              sections located in a first region of said array;
- 15          e.     compressing said array; and,
- f.     placing said compressed array in a flexible outer casing.

**18.** A method of forming a package according to Claim 9, wherein a second predetermined number of said articles have their said upper sections located in a second region of said array.

**19.** A method of forming a package according to Claim 9, comprising the following steps:

- 5           a.     transporting said articles in a consecutive manner to a folding unit;
- b.     folding said articles;
- c.     changing the orientation of said articles at regularly spaced intervals;
- 10          d.     aligning a predetermined number of said articles with said front faces or  
              back faces in a contacting relationship to form an uncompressed array,  
              wherein a predetermined number of said articles have their said upper

15 sections located in a first region of said array and a second predetermined number of said articles have their said upper sections located in a second region of said array;

e. compressing said array; and,

f. placing said compressed array in a flexible outer casing.

**20.** A method according to Claim 17 or 19, wherein the compression force is substantially uniform across said first and second regions.

**21.** A package containing an array of flexible absorbent articles, said absorbent articles comprising a front face, a back face, a top face, a bottom face, side faces, an upper section and a lower section, said sections having mutually different caliper, wherein at least a portion of said absorbent articles are placed with said front  
5 faces in a contacting relationship and at least a portion of said back faces in a contacting relationship, said package comprising a flexible outer casing, said array having a first region and a second region and said upper and lower sections of said absorbent articles being distributed over said first and second regions of said array, wherein said distribution of upper and lower sections, is such that the difference in the size of said first and second  
10 regions is at least about 10% smaller than when all of said upper sections of said absorbent articles are located in the same region of said array.

**22.** A package according to Claim 21, wherein said upper and lower sections of said absorbent articles are distributed in such a way that the sizes of said first and second regions of said array are substantially equal.

**23.** A package according to Claim 22, wherein at least a portion of said absorbent articles are placed with said bottom faces in a contacting relationship with said top faces of adjacent absorbent articles.

**24.** A package according to Claim 21, 22, or 23, wherein the orientation of said absorbent articles is periodically alternated.

**25.** A package according to any preceding Claim, wherein the dimensions of said first region of said array is substantially equal to the dimensions of said second region of said array.

**26.** A package according to any preceding Claim, wherein said absorbent articles comprise different caliper in said upper and lower sections.

**27.** A package according to any preceding Claim, wherein said package does not comprise a inner means, particularly not a paper wrapping to maintain said array of said absorbent articles.

**28.** A method of forming a package according to Claim 21, comprising the following steps:

- 5           a.     transporting said absorbent articles in a consecutive manner to a folding unit;
- b.     folding said absorbent articles;
- 10          c.     changing the orientation of said absorbent articles at regularly spaced intervals;
- d.     aligning a predetermined number of said absorbent articles with said front faces or back faces in a contacting relationship to form an uncompressed array, wherein a predetermined number of said absorbent articles have  
15               their said upper sections located in a first region of said array and a second predetermined number of said absorbent articles have their said upper sections located in a second region of said array; and,
- e.     placing said array in a flexible outer casing.

**29.** A package containing an array of compressed, flexible absorbent articles, said absorbent articles comprising a front face, a back face, a top face, a bottom face, side faces, an upper section and a lower section, said sections having mutually different compressibilities and caliper, wherein at least a portion of said absorbent articles are placed with said front faces in a contacting relationship and at least a portion of said back faces in a contacting relationship, said package comprising a flexible outer casing, said array having a first region and a second region and said upper and lower sections of said absorbent articles being distributed over said first and second regions of said array, wherein said distribution of said upper and lower sections, is such that the difference in the compression force for compression of said first and second regions to between 0% and 90% of their uncompressed volume, is at least 10% smaller than the difference in the compression force for compression of said first and second regions, when all of said upper sections of said absorbent articles are located in the same region of said array; and said flexible outer casing maintains said array of said compressed absorbent articles.

**30.** A package according to Claim 29, wherein said upper and lower sections of said absorbent articles are distributed in such a way that the compression forces for said first and second regions of said array are substantially equal.

**31.** A package according to Claim 29, wherein at least a portion of said absorbent articles are placed with said bottom faces in a contacting relationship with said top faces of adjacent absorbent articles.

**32.** A package according to Claim 29, 30, or 31, wherein the orientation of said absorbent articles is periodically alternated.

**33.** A package according to Claim 29, 30, 31, or 32, wherein, after compression, the dimension along the direction of compression of said first region of said array is substantially equal to the dimension along the direction of compression of said second region of said array.

**34.** A package according to Claim 29, 30, 31, 32, or 33, wherein after compression the expansion force of said first region is substantially equal to the expansion force of said second region.

**35.** A package according to Claim 29, 30, 31, 32, 33, or 34, wherein said absorbent articles comprise different caliper in said upper and lower sections.

**36.** A package according to Claim 29, 30, 31, 32, 33, 34, or 35, wherein said package does not comprise an inner means, particularly not a paper wrapping to maintain said array of said compressed absorbent articles.

**37.** A method of forming a package according to Claim 29, comprising the following steps:

- a. transporting said absorbent articles in a consecutive manner to a folding unit;
- b. folding said absorbent articles;
- c. changing the orientation of said absorbent articles at regularly spaced intervals;
- d. aligning a predetermined number of said absorbent articles with said front faces or back faces in a contacting relationship to form an uncompressed array, wherein a predetermined number of said absorbent articles have their said upper sections located in a first region of said array;
- e. compressing said array; and,
- f. placing said compressed array in a flexible outer casing.

**38.** A method of forming a package according to Claim 29, wherein a second predetermined number of said absorbent articles have their said upper sections located in a second region of said array.

**39.** A method of forming a package according to Claim 29, comprising the following steps:

- 5           a.     transporting said absorbent articles in a consecutive manner to a folding unit;
- b.     folding said absorbent articles;
- 10          c.     changing the orientation of said absorbent articles at regularly spaced intervals;
- d.     aligning a predetermined number of said absorbent articles with said front faces or back faces in a contacting relationship to form an uncompressed array, wherein a predetermined number of said absorbent articles have  
15               their said upper sections located in a first region of said array and a second predetermined number of said absorbent articles have their said upper sections located in a second region of said array;
- e.     compressing said array; and,
- 20          f.     placing said compressed array in a flexible outer casing.

**40.** A method according to Claim 37 or 39, wherein the compression force is substantially uniform across said first and second regions.

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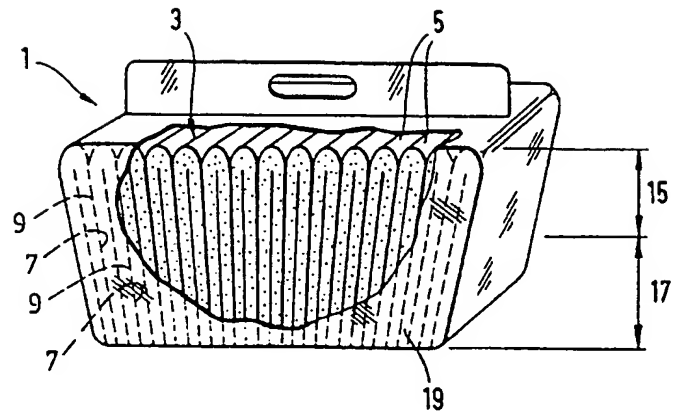


FIG. 1

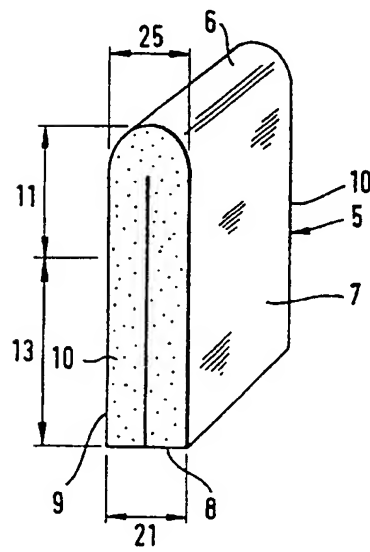


FIG. 2

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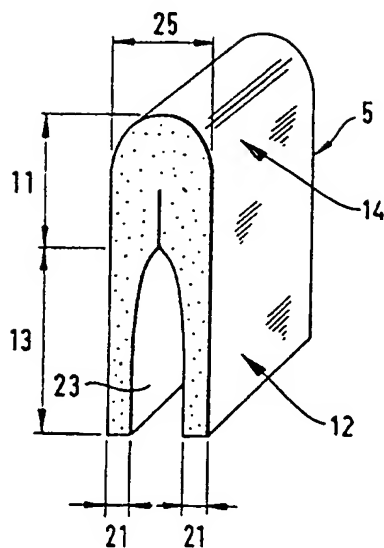


FIG. 3

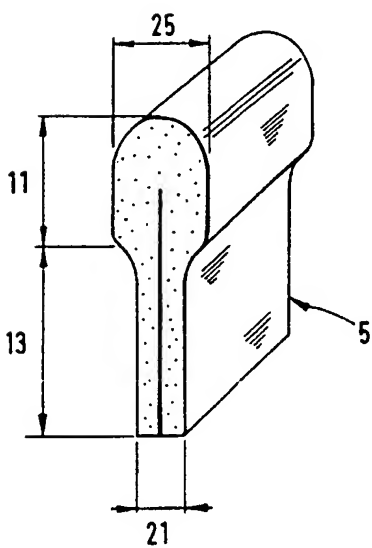


FIG. 4



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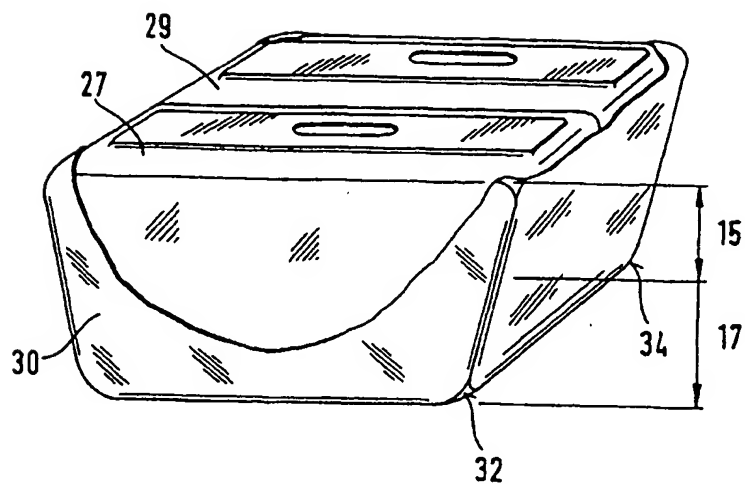


FIG. 5

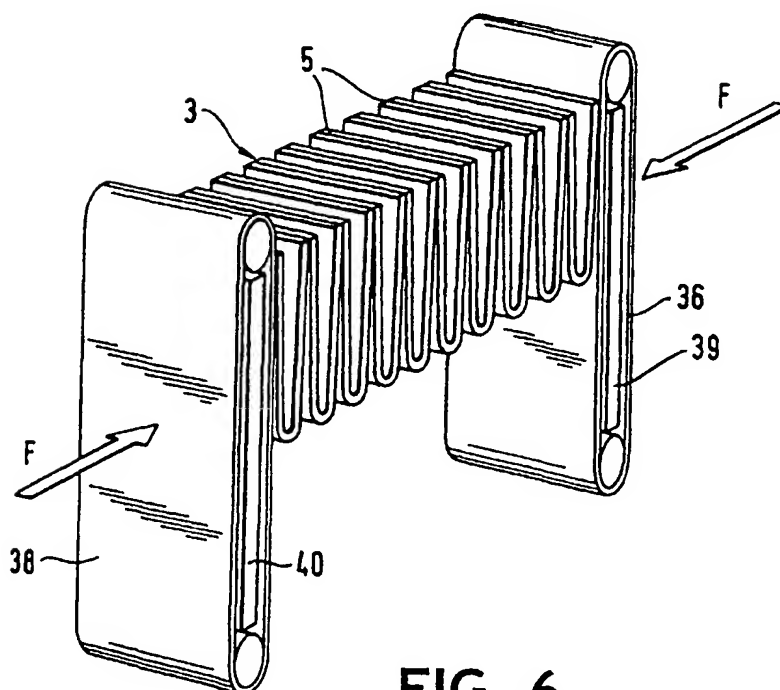


FIG. 6

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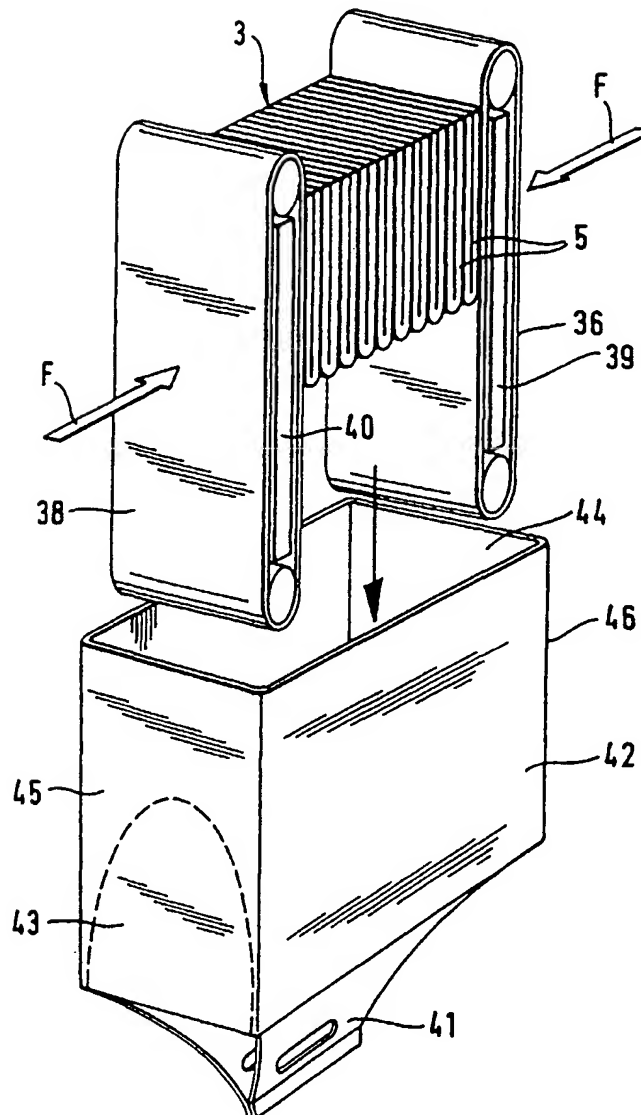


FIG. 7



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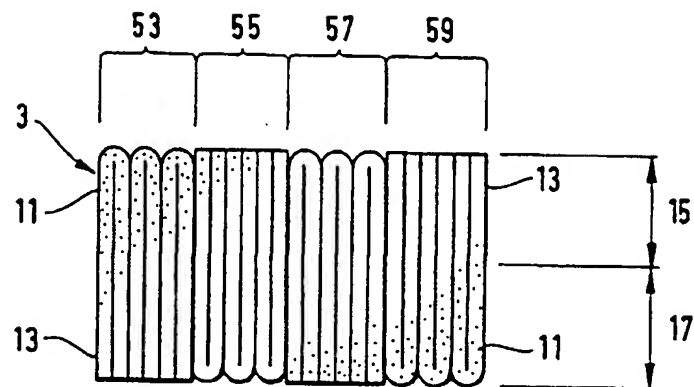


FIG. 10

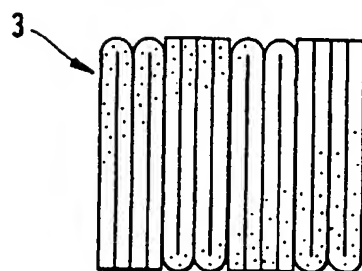


FIG. 11

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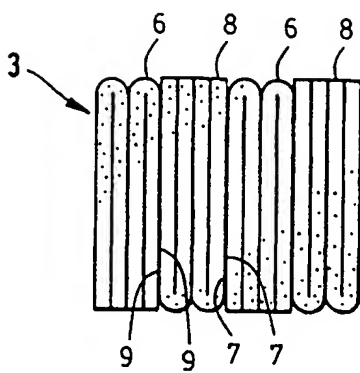


FIG. 11a

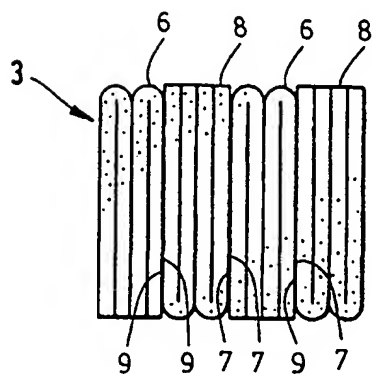


FIG. 11b

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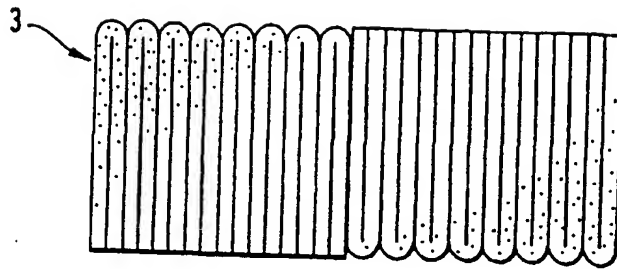


FIG. 12

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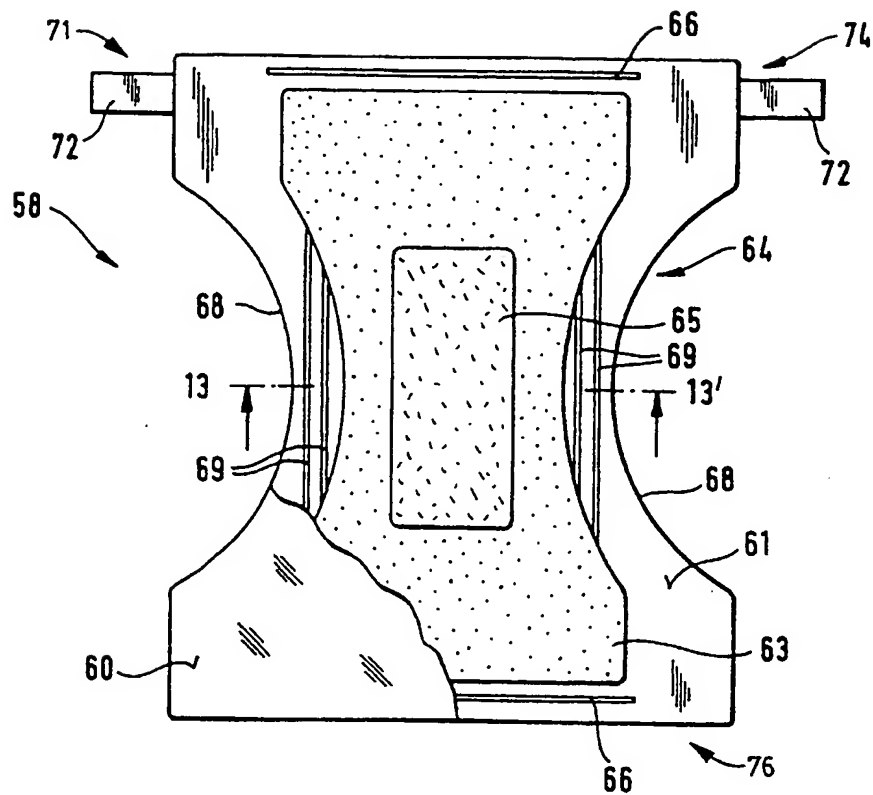


FIG. 13

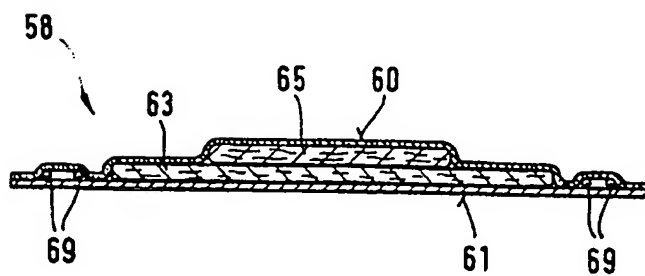


FIG. 14

# INTERNATIONAL SEARCH REPORT

Intern. Nat. Application No  
PCT/US 99/29522

## A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 B65D85/16

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 B65D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 780 325 A (PROCTER & GAMBLE) 25 June 1997 (1997-06-25) the whole document	1-40
X	EP 0 618 148 A (PROCTER & GAMBLE) 5 October 1994 (1994-10-05)  column 3, line 41 -column 10, line 2; figures 1,3	1-6, 8-15, 17-26, 28-35, 37-40
A	EP 0 391 460 A (PROCTER & GAMBLE) 10 October 1990 (1990-10-10) column 3, line 50 - line 32; figures 1-12  -/-	1

☒ Further documents are listed in the continuation of box C.

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# INTERNATIONAL SEARCH REPORT

International Application No  
PCT/US 99/29522

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